STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
SITE INVESTIGATION AND RESTORATION BRANCH
FINAL PLAN OF REMEDIAL ACTION

April 2007

Christina Marina Property
Wilmington, Delaware ***DNREC Project No. DE-1293***

This Final Plan of Remedial Action (Proposed Plan) presents the Department of Natural Resources and Environmental Control's (DNREC's) chosen cleanup alternative for the remediation of the Christina Marina property ("Site") located in Wilmington, Delaware. For site-related reports and more information, please see the Public Participation section of this document.

The purpose of the Final Plan is to provide specific information about contamination present at the Site, the cleanup alternatives that DNREC considered, and the chosen remediation of the Site. In addition, as described in Section 12 of the Delaware Regulations Governing Hazardous Substance Cleanup (Regulations), DNREC provided notice to the public and an opportunity for the public to comment on the Proposed Plan. At the comment period's conclusion, DNREC reviewed and considered all of the comments received and is issuing a Final Plan of Remedial Action (Final Plan). The Final Plan designates the selected remedy for the Site. All investigations of the Site, the Proposed Plan, comments received from the public, DNREC's responses to the comments, and the Final Plan will constitute the Remedial Decision Record.

This Final Plan summarizes the Remedial Investigation (RI) performed in June 2005 by BrightFields, Inc. (BrightFields), a Hazardous Substance Cleanup Act (HSCA)-certified environmental consulting firm. It is based on the results of the previous investigations performed at the Site. This Final Plan is issued under the provisions of the HSCA and the Regulations. It presents the Department's assessment of the potential health and environmental risk posed by the Site. This report is included in the administrative record file upon which the remedy is based. Copies of the site-related documents can be obtained or viewed at locations listed at the end of this document.

1.0 INTRODUCTION

The Christina Marina property is located on the East 7th Street Peninsula at 1126 East 7th Street and is adjacent to the Christina River in Wilmington, Delaware (Figure 1). The DNREC-Site Investigation and Restoration Branch (SIRB) certified the Site as a Brownfield on September 17, 2004. The 7th Street Associates, LLC entered into a Brownfields Development Agreement (BDA) with DNREC for this Site under the provisions of the Delaware Hazardous Substance Clean-up Act (HSCA), 7 Del. C. Chapter 91. The BDA was executed on August 28, 2006. On behalf of the 7th Street Associates, LLC, BrightFields was contracted to perform the Remedial Investigation (RI) and the Focused Feasibility Study (FFS) to evaluate the potential risks posed to public health, welfare and the environment. The RI was finalized in June 2005, and the FFS was finalized in October 2006.

The purpose of the RI and FFS was to: 1) characterize the nature and extent of any soil, sediment, and groundwater contamination at the Site, 2) evaluate risks to public health, welfare and the environment associated with the identified contamination, and 3) to evaluate and recommend a Remedial Action.

All work was performed during the RI and FFS in a manner consistent with:

- Delaware Hazardous Substance Cleanup Act, 7 Del. C. Chapter 91 (July, 1995);
- Standard Operating Procedures for Chemical Analytical Programs (SOPCAP) (April, 1996);
- HSCA Guidance Manual (October, 1994);
- Voluntary Cleanup Program (VCP) Guidance Manual (November, 1995);
- Remediation Standards Guidance under the Delaware HSCA (December, 1999);
- The DNREC-approved RI Work Plan (WIK, 2003); and
- The Requirements set forth by DNREC.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Setting

The Site is approximately 8.4 acres and is comprised of one (1) parcel (tax parcel # 26-044.00-013) approximately 6.8 acres in size, and one (1) parcel (tax parcel # 26-044.00-044) approximately 1.6 acres in size. Approximately 8.0 acres are located west of 7th Street and 0.4 acres are located east of 7th Street. Surrounding land is generally commercial and/or industrial. The 8.0 acre portion is bounded by 7th Street to the east, a vacant City of Wilmington property to the south, the Christina River to the west, and Marine Lubricants to the north. The 0.4-acre section is bounded by roads on three (3) sides and by a property owned by Peninsula Ventures IV, LLC to the southeast. The Site is comprised of approximately 5.7 acres of land and approximately 2.7 acres of water (Figure 2).

2.2 Site and Project History

The Site is located in a historically industrial area, where soil has been impacted by metals and organic compounds. Based on a review of historical maps and aerial photographs it appears that prior to Fort Christina Marina, there was no development on the property. A significant portion of the 7th Street Peninsula was reportedly used by the City of Wilmington as a municipal landfill from the 1940s through the 1960s. The Peninsula was then overlain with varying depths of ash from the City of Wilmington's incinerators. Portions of the Peninsula were also filled with various types of construction debris and fill material.

The Site is currently vacant, but the former marina block building still remains onsite, and the rest of the property is primarily covered with gravel. The Site is surrounded by a locked fence, except for the 0.4-acre section noted above. The Urban Development Action Grant Program (UDAG) currently owns the property.

2.3 Development Plans

The proposed plans for development of the Site by 7th Street Associates, LLC include importing DNREC-approved fill to raise the site elevation above the floodplain and redevelopment as shown on the Conceptual Development Plan (Figure 3). The construction will include demolishing the existing structure, regrading and filling the property to accommodate the construction of residential townhouses, supporting commercial/retail facilities, and parking.

3.0 REMEDIAL INVESTIGATION

The following previous investigation reports and information were reviewed and utilized in Brightfield's preparation of the RI report (Brightfields, June 2005):

- DNREC, 1999, BPA II Wilmington, Delaware E. Seventh Street Peninsula – "Northside". September 1999.
- DNREC, 1999, BPA II Wilmington, Delaware E. Seventh Street Peninsula – "Southside". June 1999.

The RI report detailed the scope of work that included a review and summary of the historical data for the Site, the collection of soil, groundwater, and sediment samples, and submission of these samples for laboratory analysis. The RI also included an initial ecological evaluation and an evaluation of risk posed by the substances identified in the soil, groundwater, and sediment. The data was compared to DNREC-SIRB's Uniform Risk-based Remediation Standards (URS) values for both Restricted (residential) and Unrestricted (commercial/industrial) Use Criteria. Sediment data was also compared to National Oceanic and Atmospheric Administration (NOAA) Freshwater Probable Effects Level (PEL) criteria. The results of the risk evaluation were used to develop the conclusions of the RI, and were incorporated in the FFS for the Site. The following is a summary of the findings based on the RI data and the previous investigations on the Former Christina Marina Property:

3.1 Soil Sampling and Conclusions

- Test pit and well-drilling logs indicated that portions of the Site are filled with municipal solid waste (up to 9 feet thick) and are underlain by marsh deposits.

- Twenty-four (24) samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and pesticides/polychlorinated biphenyls (PCBs) at DNREC's laboratory. Five (5) of the samples were analyzed at STL Edison Laboratory for confirmatory analysis for target compound list (TCL) VOCs, TCL SVOCs, TCL pesticides/PCBs, and target analyte list (TAL) metals and cyanide.

- Aluminum, arsenic, barium, chromium, iron, lead, manganese, mercury, vanadium, multiple polycyclic aromatic hydrocarbons (PAHs), pesticides and multiple PCBs were detected in the Site's soil above the corresponding unrestricted use URS values. Arsenic, iron, lead and multiple

PAHs were detected in the Site's soil above the corresponding unrestricted use URS values, but below the corresponding restricted use URS values. (See Table 1).

TABLE 1

Contaminant of Concern (COC)	95% UCL Concentration[1] (mg/kg)	DNREC Unrestricted URS[2] (mg/kg)	DNREC Restricted URS[3] (mg/kg)
METALS			
Aluminum	**22,100**	7,800	200,000
Arsenic	**92.4**	11^	11^
Barium	**883**	500	14,000
Chromium	**547**	270	610
Copper	**296**	310	8,200
Iron	**87,200**	2,300	61,000
Lead	**1,930**	400	1,000
Manganese	**738**	160	4,100
Mercury	**38.7**	10	610
Vanadium	**224**	55	1,400
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)			
Benzo(a)anthracene	**10**	0.9	8
Benzo(b)fluoranthene	**10**	0.9	8
Benzo(k)fluoranthene	**11**	9	78
Benzo(a)pyrene	**9.9**	0.09	0.8
Dibenz(a,h)anthracene	**1.3**	0.09	0.8
Fluorene	**2.6**	0.03	5,000
Indeno(1,2,3-cd)pyrene	**4.8**	0.9	8
PESTICIDES/PCBs			
Aroclor-1248	**0.760**	0.3	3
Aroclor-1254	**0.707**	0.3	3
Dieldrin	**0.0251**	0.04	0.4
Heptachlor epoxide	**0.0410**	0.07	0.06

Notes:
[1] Mean concentration calculated using the 95% Upper Confidence Limit (UCL) method
[2] DNREC Unrestricted Use, Non-Critical Water Resource Area Uniform Risk-Based Standards
[3] DNREC Restricted Use, Non-Critical Water Resource Area Uniform Risk-Based Standards
^ The Default Background Standard value for Arsenic (DNREC policy, 2007)
Bold Values- mean concentrations exceeds DNREC Unrestricted URS
Chromium concentrations reflect total chromium concentrations.
Chromium URS values listed are for chromium III, the most conservative value.

- The cumulative risk calculations indicate that exposure to the Site's soil in its current state may pose an unacceptable cancer risk under both unrestricted and restricted use scenarios, but does not pose an unacceptable non-cancer risk under a restricted use scenario. The elevated concentrations of iron found in the soil result in an unacceptable non-cancer risk under an unrestricted use scenario, however, the concentrations are within the range of background values for iron found in Delaware soils.

3.2 Groundwater Sampling and Conclusions

- Based on groundwater elevations measured in the wells, the groundwater flow direction is toward the southwest (towards the Christina River).

- Three (3) monitoring wells were installed and four (4) groundwater samples were collected and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals and cyanide. Arsenic was determined to be the only contaminant of concern (COC) in the groundwater.

- Arsenic, iron, and manganese were detected above the URS in the Site's groundwater (see table below), therefore, human consumption of groundwater from the Site may pose an increased cancer risk. The property is located within a Groundwater Management Zone (GMZ), an area where the use of groundwater is restricted by DNREC. No new public or domestic water supply wells are permitted to be installed within the GMZ, and all existing water supply wells are located greater than 2 miles from the Site. Since there is not a complete pathway for groundwater ingestion, the Site's groundwater does not appear to pose an increased cancer risk to human health under current and anticipated future use scenarios (See Table 2).

TABLE 2

Contaminant of Concern (COC)	95% UCL Concentration[1] (ug/L)	DNREC Groundwater URS (ug/L)
METALS		
Arsenic	161	50
Iron	126,000	300
Manganese	3,980	50

Notes:
[1] Mean concentration calculated using the 95% Upper Confidence Limit (UCL) method

- The mass loading calculations performed indicated that groundwater at the Site is not a significant source of contamination to the Christina River.

3.3 Sediment Sampling and Conclusions

- Six (6) sediment samples were analyzed for TCL SVOCs, TCL pesticides/PCBs, and TAL metals and cyanide, and two (2) sediment samples were analyzed for TCL VOCs. Arsenic, barium, cadmium, copper, lead, mercury, nickel, zinc, PAHs, 4,4-DDE and 4,4-DDT were detected above the corresponding URS values (See Table 3).

TABLE 3

Contaminant of Concern (COC)	95% UCL Concentration[1] (mg/kg)	DNREC Sediment URS (mg/kg)
METALS		
Arsenic	28.4	8
Barium	285	20
Cadmium	2.0	1
Copper	112	34
Lead	479	47
Mercury	0.495	0.2
Nickel	29.7	21
Zinc	517	150
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)		
Benzo(a)anthracene	0.880	0.1
Benzo(a)pyrene	0.839	0.1
Toluene	0.500	0.05
Phenol	0.297	0.03
Acenaphthene	0.340	0.09
Fluorene	0.290	0.1
Phenanthrene	1.43	0.5
Anthracene	0.370	0.3
Fluoranthene	1.83	0.8
Chrysene	0.902	0.9
PESTICIDES		
4,4'-DDE	0.0313	0.03
4,4'-DDT	0.0124	0.002

Notes:
[1] Mean concentration calculated using the 95% Upper Confidence Limit (UCL) method

- Metals, pesticides, and PAHs were detected at concentrations above the corresponding URS values in the sediment samples collected at the Site. However, these compounds were also detected in upstream and adjacent sediment samples at similar concentrations.

4.0 RISK EVALUATION

A risk assessment was performed to evaluate the possible effects on human health and a mass loading evaluation was performed to assess possible impact to the environment, specifically the Christina River, from the COCs at the Site. The primary exposure pathways are:

Exposure to Soil or Groundwater

If the Site remains in its current condition, future site users could have direct exposure to contaminated soil, sediment, and/or groundwater. Direct exposure could include dermal contact, direct injection, and/or incidental ingestion of site soils or groundwater. Under the current site usage, this is an unlikely scenario because the Site is vacant, mostly behind a locked fence, and the Site is located within a GMZ. In the

future, when the Site is redeveloped, direct exposure is a likely scenario during any subsurface activities of the construction phase. After any potential subsurface construction has been completed, this exposure scenario is again unlikely, whether the redevelopment is residential or commercial.

Inhalation Via the Air Pathway

Given the "inhalation via air pathway" exposure scenario, the potential for individuals working or living on or downwind of the Site breathing airborne contaminated dust has been evaluated. Since the Site is vegetated, paved, or covered by gravel or buildings, dust is not emitted in its current state. When the Site is redeveloped, this is a possible scenario during any subsurface activities that would be performed during the construction phase. After any subsurface construction is completed, this exposure scenario is again unlikely, whether the redevelopment is either commercial or residential.

Contact with the Christina River Surface Water

The Christina River is a surface water body often used by people for recreation activities such as boating and fishing. In this exposure scenario contaminants from the Site can potentially leach or travel through, the on-site soil and/or be transported in rainfall runoff. The Site's COCs have the potential to migrate via the groundwater or surface water pathways to surface water, specifically the Christina River. During previous investigations, sample results for well M-GW01 contained elevated concentrations of arsenic, the only groundwater COC.

5.0 REMEDIAL ACTION OBJECTIVES

According to Section 8.4 (1) of the HSCA Regulations, site-specific remedial action objectives (RAOs) must be established for all plans of remedial action. The Regulations provide that DNREC will set objectives for land use, resource use, and cleanup levels that are protective of human health and the environment. The site is currently zoned as waterfront residential and commercial, and redevelopment into townhomes and commercial/retail, including parking areas and landscaping. The following qualitative and quantitative RAOs are appropriate for the Site:

Qualitative Objectives:

- Prevent potential human contact (dermal, inhalation, and ingestion) with source materials contaminated soil, sediment, and/or groundwater.
- Protect environmental receptors by controlling contaminated soil erosion and subsequent overland transport of contaminated soil in surface water to the Christina River.
- Properly reuse or dispose of all excavated soil or groundwater from dewatering generated during construction.

Quantitative Objectives:

- Prevent human exposure to soil and other media contaminated with PAHs having a cumulative increased risk factor for cancer-causing compounds of greater than $10E^{-05}$ and/or a hazard index of 1.

- Prevent human exposure to soil with concentrations of lead greater than 400 mg/kg and arsenic greater than 11 mg/kg.
- Mitigate the potential for environmental impacts to the Christina River, due to offsite migration of site contaminants entrained in stormwater runoff.
- Manage and mitigate environmental risks, as they occur during the building construction and redevelopment process, in accordance with the DNREC-approved, site-specific Contaminated Material and Water Management Work Plan and the site-specific Health and Safety Plan.

The RAOs were based on the following factors:

- Surrounding land uses are commercial, although residential and commercial redevelopment is anticipated.
- Soil at the Site has been impacted by various chemical contaminants. Based on the nature and extent of these contaminants, the primary restricted-use soil COCs at the Site are arsenic, lead, and PAHs. Iron was not retained as a COC because the concentrations did not exceed background values. The primary unrestricted-use soil COCs at the Site are arsenic, barium, vanadium, lead, PCBs, and PAHs. Iron, manganese, and aluminum were not retained as COCs because the concentrations did not exceed background values.

6.0 EVAULATION OF REMEDIAL ALTERNATIVES

The four remedial alternatives evaluated for this Site in the FFS included:

- Alternate 1- No Action, which assumes that the property remains in its current condition with no remedial action. This option is only used for reference purposes.
- Alternate 2- Soil Capping, which involves the placement of at least two feet of DNREC-approved fill across the surface of the property, and restricts intrusive activities. Possible contact with the impacted soil will be further mitigated through the construction of townhomes, commercial/retail facilities, paved parking areas and landscaping and through the placement of environmental covenants on the property restricting gardening, fence installation, and other residential intrusive-type activities.
- Alternate 3- Soil Capping and Groundwater Monitoring, which adds groundwater monitoring to Alternative 2. This would allow monitoring of contaminant concentrations in the groundwater so that steps can be taken to mitigate the problem if significant increases in the concentrations of the COCs are detected.
- Alternate 4- Removal of Contaminated Soil and Debris, which calls for the excavation and offsite disposal of all contaminated soil, as well as all municipal waste present on-site, followed by backfilling with DNREC-approved fill.

7.0 FINAL PLAN OF REMEDIAL ACTION

The redevelopment will be implemented in several phases and the appropriate remedial action will be implemented in conjunction with each phase of the redevelopment. Based on DNREC's evaluation of the Site information, which includes current and past environmental investigations, historical information, the above remedial action objectives, and the evaluation of the proposed remedies, DNREC requires that the following remedial actions be taken at the Site:

1. The placement of at least two feet of DNREC-approved fill over the Site as a cap in order to prevent exposure to impacted media.

2. Install and maintain sufficient stabilization measures to prevent contributions of contaminated material to the Christiana River.

3. The monitoring of groundwater quality from the existing shallow wells and deep well to determine if metal content significantly increases. After site construction and the abandonment of the existing wells, four (4) new wells will be installed and monitored for Resource Conservation and Recovery Act (RCRA) metal semi-annually for two (2) years and annually for the following eight (8) years. Well locations and if needed further monitoring will be determined by DNREC.

4. Health and safety oversight during intrusive construction activities. Since this alternative does not include removal of impacted media, any construction work that involves disturbance of the original surface could expose workers to impacted media. Because of that, the alternative also includes health and safety monitoring during construction. The developer will be expected to complete construction, including the proper handling and disposal of all soil and groundwater removed from the Site, in accordance with DNREC's regulations, a site-specific Health and Safety Plan (HASP) and a site-specific Contaminated Materials and Water Management Work Plan (CMWMWP). Soil excavated while installing utility corridors and foundation structures would either be reused on the Site or properly disposed of off-site, depending on contaminants present and their concentrations.

5. An Operations and Maintenance (O&M) Plan to provide procedures for evaluating the integrity of the cap following site construction. The O&M Plan will indicate that the site owners will bear the cost of the long term maintenance, as specified in the O&M Plan, for this Site.

6. The placement of an environmental covenant, consistent with Delaware's Uniform Environmental Covenants Act, UECA (Title 7, Del. Code Chapter 79, Subtitle 11), will be required at the Site, within 90-days following DNREC's adoption of the Final Plan of the Remedial Action. This covenant will be used as a precaution against the final cover being compromised by future redevelopment, utility relocation or other subsurface land activities. The environmental covenant will describe the following:

    a.) Any land disturbing activities will be prohibited including, but not limited to digging, drilling, construction, earth moving without DNREC's prior written approval. DNREC's approval will require a DNREC-approved Site Specific Contaminated Material Management Plan and Health and Safety Plan. All such work is to be monitored by a HSCA-certified consultant.

    b.) A restriction on the use of groundwater as specified in the GMZ.

    The monitoring of the site use and any site maintenance necessary to restrict inadvertent site exhumation will be the responsibility of the site owner, or in the event no viable responsible site owner can be identified, these long-term stewardship (LTS) duties will be performed by DNREC if funding (e.g., continued HSCA resources) is available.

8.0 PUBLIC PARTICIPATION

The Department actively solicited written public comments and suggestions on the Proposed Plan of Remedial Action. The comment period began March 14, 2007 and ended on April 4, 2007. No comments were received. If you have any questions or concerns regarding the Christina Marina site, or if you would like to review the reports or other information regarding the Site, please either of the project managers, Lindsay J. Hall or Morgan M. Price, 391 Lukens Drive, New Castle, Delaware 19720 or at 302.395.2600.

9.0 DECLARATION

The Final Plan of Remedial Action for the Christina Marina site is protective of human health, welfare and the environment, and is consistent with the requirements of the Delaware Hazardous Substance Cleanup Act.

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James D. Werner
Director, Division of Air and Waste Management

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Date of Review

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Figure 1

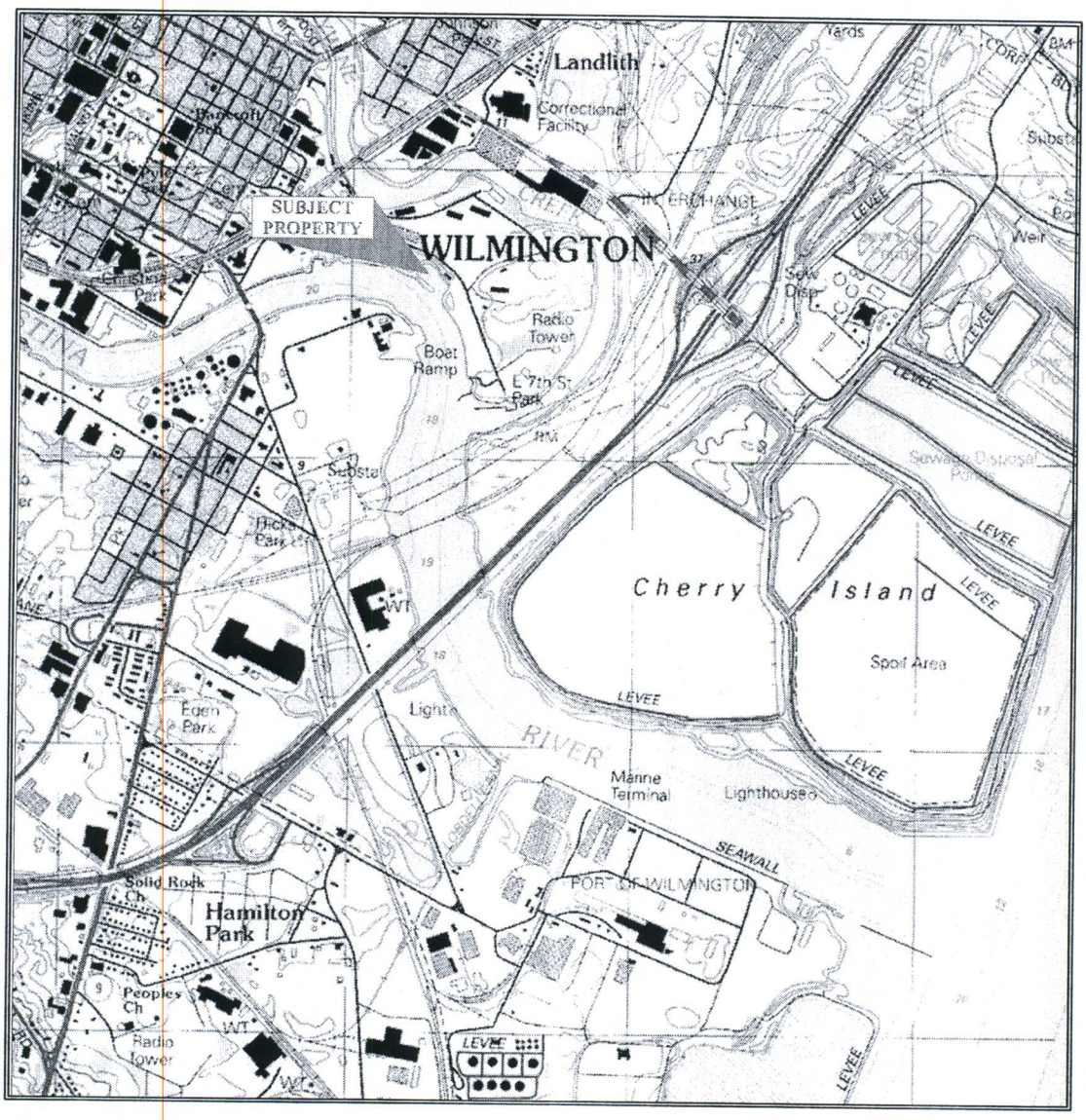

FIGURE 1 - Site Location Map

From USGS Wilmington South Quadrangle
Wilmington Del - N.J.
7.5 minute series, 1993

7th Street Associates Property
E. 7th Street Peninsula, Wilmington, Delaware

File No. 0508.27.51

0 2,000
SCALE (feet)

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Figure 2

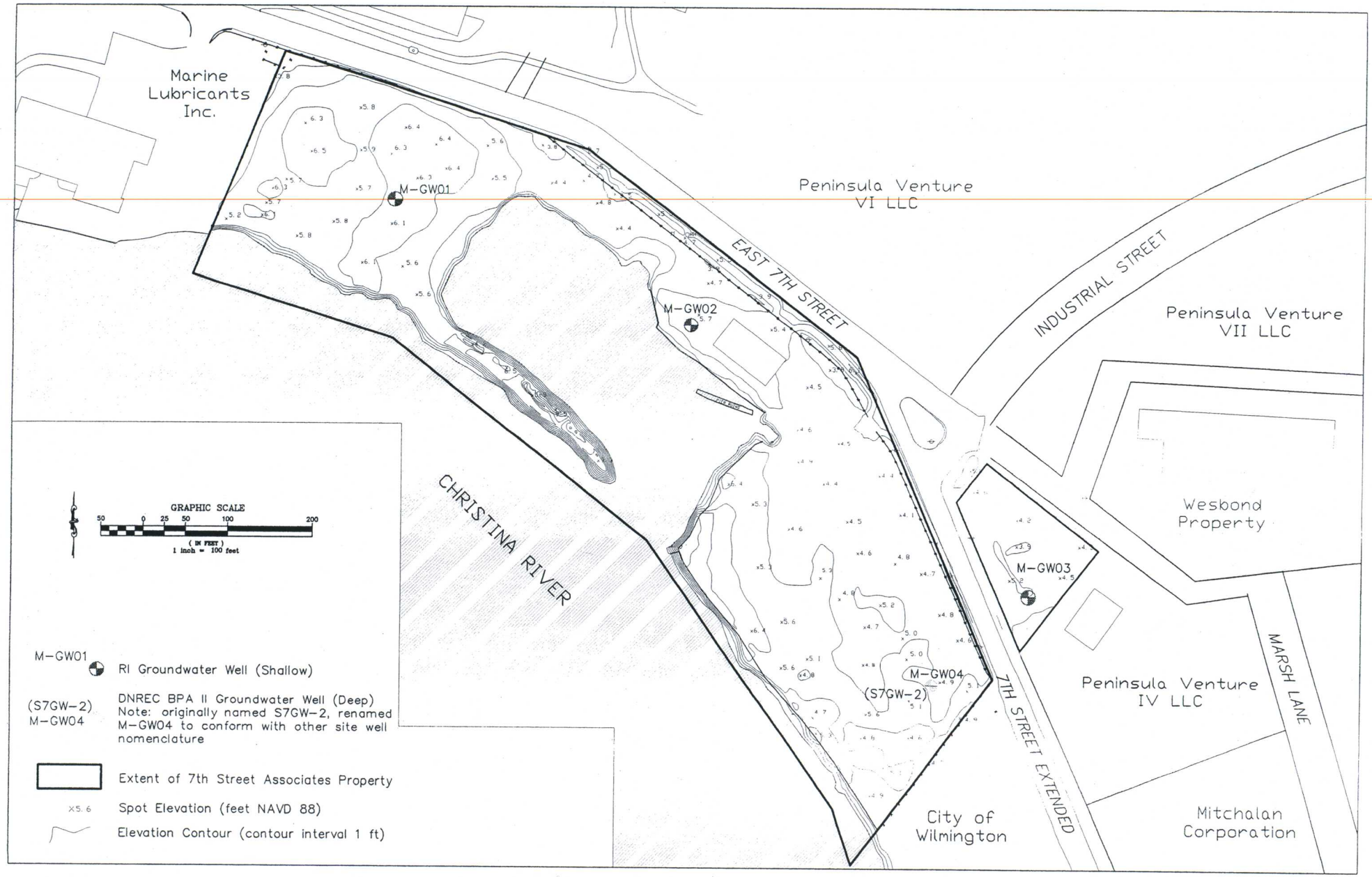

FIGURE 2: Groundwater Monitoring Well Locations

Figure 3

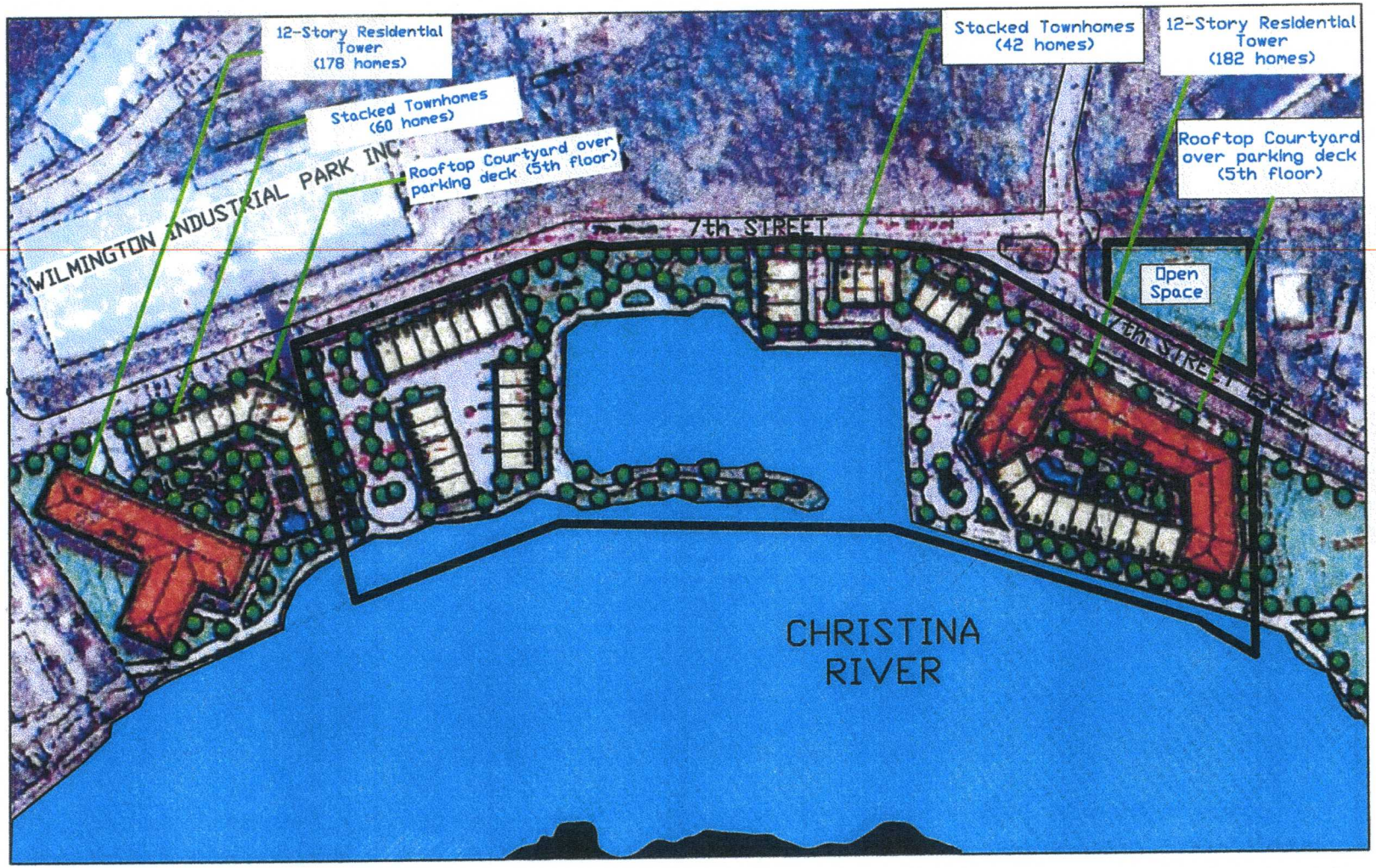

FIGURE 3: Conceptual Development Plan